

REMARKS

Claims 1-11 and 21-31 are pending in the application.

Applicants have amended claim 6 in accordance with the Examiner's suggestion. The changes to claim 6 do not introduce any new matter.

Applicants note that the Office Action Summary page states that claims 1-11 and 24-31 are pending in the application; however, claims 1-11 and 21-31 are actually pending in the application. In this regard, Applicants note that claims 21-24 were rejected for obviousness in the Office Action. Accordingly, Applicants respectfully request that the list of pending claims in the Office Action Summary be corrected in the next Office Action.

Applicants respectfully request reconsideration of the rejection of claims 2-11 under 35 U.S.C. § 112, second paragraph, as being indefinite. In accordance with the Examiner's suggestion, Applicants have amended claim 6 to delete "predetermined" from lines 5 and 6 of the claim. In response to the Examiner's assertion that "the wetting operation," "the operation of wetting," "the scrubbing operation," and "the wetting and scrubbing operations" in claims 2-11 lack antecedent basis, Applicants respectfully submit that the initial recitation of the method operation, e.g., wetting or scrubbing, provides antecedent basis for the subsequent recitation of the particular operation, e.g., the wetting operation or the scrubbing operation. In support of their position, Applicants submit that the recitation of, e.g., "a wetting operation" or "a scrubbing operation," would be confusing in that such recitation introduces a new method operation rather than referring back to the previously introduced method operation. In view of the foregoing, Applicants submit that claims 2-11, as amended herein, now satisfy the definiteness requirement of 35 U.S.C. § 112, second paragraph, and request that the rejection of these claims thereunder be withdrawn.

Applicants respectfully request reconsideration of the rejection of claim 1 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,882,489 to Bersin et al. ("the

Bersin patent”). As will be explained below, the Bersin patent does not disclose each and every feature of claim 1.

Independent claim 1 defines a method of cleaning the surface of a semiconductor wafer following a plasma etching operation. This method includes the operation of wetting the surface of the semiconductor wafer by using a non-splash rinse technique.

The Bersin patent discloses a process for cleaning and stripping photoresist from surfaces of semiconductor wafers. The process includes a plasma operation to remove organic compounds, a rinsing operation in deionized (DI) water, and a sputtering operation to remove inorganic compounds. Regarding the rinsing operation, the Bersin patent states that “the wafer is removed from chamber 80 and provided to rinsing station 82 for a rinse in DI water, optionally with ultrasonic agitation. This rinsing step washes away the organic material, leaving only insoluble inorganic residues.” Column 4, lines 24-28.

The Bersin patent does not disclose each and every feature of the method defined in independent claim 1 for at least the reason that this reference does not disclose the use of a non-splash rinse technique. In fact, the Bersin patent does not describe any of the pertinent parameters for obtaining a non-splash rinse set forth in Applicants’ specification, e.g., the rotational speed of the wafer, the flow rate of the rinse water from the outlet, and the positioning of the outlet used to deliver the rinse water relative to the surface of the wafer. To the extent that the anticipation rejection may be based on principles of inherency, Applicants note that a reference inherently discloses a claimed feature only when that feature *necessarily* results from the teachings of the reference. See M.P.E.P. § 2112. The Bersin patent does not describe either the use of a non-splash rinse technique or any of the parameters required to obtain non-splash rinse conditions. Thus, the Bersin patent does not reasonably support an assertion that the disclosed rinsing operation is necessarily performed

under non-splash rinse conditions. As such, the Bersin patent does not disclose each and every feature of claim 1, either expressly or under principles of inherency.

Accordingly, for at least the foregoing reasons, independent claim 1 is patentable under 35 U.S.C. § 102(e) over the Bersin patent.

Applicants respectfully request reconsideration of the rejection of claims 2-11 under 35 U.S.C. § 103(a) as being unpatentable over Bersin in view of U.S. Patent No. 5,809,832 to Gockel et al. ("the Gockel patent"). As will be explained below, the combination of the Bersin patent in view of the Gockel patent would not have suggested to one having ordinary skill in the art the methods defined in claims 2-11.

Each of claims 2-11 ultimately depends from independent claim 1. As discussed above, claim 1 defines a method of cleaning the surface of a semiconductor wafer following a plasma etching operation that includes the operation of wetting the surface of the semiconductor wafer by using a non-splash rinse technique.

The Gockel patent discloses a semiconductor processing system that includes, among other things, a brush box containment apparatus for use with volatile chemical solutions, a roller positioning apparatus, and a brush placement device. The Gockel patent discloses that a wafer may be sprayed with water at a number of locations within the disclosed system including the load station, the brush box, and the spin, rinse, and dry station. Nothing in the Gockel patent, however, discloses or suggests wetting the surface of a wafer by using a non-splash rinse technique. Thus, the Gockel patent does not cure the deficiency of the Bersin patent relative to claim 1.

Accordingly, independent claim 1 is patentable under 35 U.S.C. § 103(a) over the combination of Bersin in view of Gockel. Dependent claims 2-11, each of which ultimately depends from claim 1, are likewise patentable under 35 U.S.C. § 103(a) over the combination of Bersin in view of Gockel for at least the same reasons set forth above for claim 1.

Applicants respectfully request reconsideration of the rejection of claims 21-24 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,804,091 to Lo et al. (“the Lo patent”) in view of Gockel. As will be fully explained below, the combination of the Lo patent in view of the Gockel patent would not have suggested to one having ordinary skill in the art the methods defined in claims 21-24.

Independent claim 21 defines a method for cleaning a surface of a semiconductor wafer after a plasma etching operation. This method includes the operation of wetting the surface of the semiconductor wafer by using a non-splash rinse technique. The non-splash rinse technique includes setting the outlet end of at least one delivery source at a specific angle relative to the surface of the semiconductor wafer, and applying liquid to the surface of the semiconductor wafer through the outlet end of the at least one delivery source.

The Lo patent discloses a method for preventing defects and particles after a tungsten etch-back operation. In the disclosed method, residues on the surface of a titanium nitride layer are removed by subjecting the wafer to megasonic shaking in deionized water. This step is also referred to as “D.I. water flushing with megasonic shaking.” Column 2, lines 31-32. As such, the Lo patent does not disclose or suggest wetting a surface of a semiconductor wafer by using a non-splash rinse technique as specified in claim 21. As discussed above, the Gockel patent does not disclose or suggest wetting a surface of a semiconductor wafer by using a non-splash rinse technique. Thus, the combination of the Lo patent in view of the Gockel patent would not have suggested to one having ordinary skill in the art the method defined in claim 21.

Accordingly, independent claim 21 is patentable under 35 U.S.C. § 103(a) over the combination of Lo in view of Gockel. Dependent claims 22-24, each of which depends from claim 21, are likewise patentable under 35 U.S.C. § 103(a) over the combination of Lo in view of Gockel for at least the same reasons set forth above for claim 21.

Applicants respectfully request reconsideration of the rejection of claims 25-31 under 35 U.S.C. § 103(a) as being unpatentable over Gockel. As will be explained below, the Gockel patent would not have suggested to one having ordinary skill in the art the methods defined in claim 25-31.

Independent claim 25 defines a method for cleaning a surface of a semiconductor wafer in which a semiconductor wafer that has been subjected to a plasma etching operation is received. An outlet end of at least one liquid delivery source is positioned relative to the surface of the semiconductor wafer so that the outlet end overlies an edge of the wafer by a distance in a range from about 2 mm to about 30 mm, the outlet end is oriented at an angle in a range from about 5 degrees to about 35 degrees relative to the surface of the wafer, and the outlet end is disposed above the surface of the wafer by a distance in a range from about 2 mm to about 15 mm. Liquid is applied to the surface of the wafer through the outlet end of the at least one liquid delivery source. Dependent claims 26-31 specify additional features of the method defined in claim 25.

As discussed in Applicants' specification, the positioning of the liquid outlet in accordance with the parameters specified in independent claim 25 minimizes splashing during wetting of the surface of a semiconductor wafer. The Examiner acknowledges that the Gockel patent does not disclose the parameters specified in independent claim 25, but alleges that the specified parameters would have been obvious to one having ordinary skill in the art as a matter of routine experimentation. In support of this allegation, the Examiner asserts that the claimed parameters "are well-known variables in the art of cleaning semiconductor wafers and known to affect both the rate and quality of the cleaning process." Office Action at page 8.

As set forth in M.P.E.P. § 2144.05, Part II.B, "[a] particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result,

before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation.” Applicants respectfully submit that the prior art does not recognize that the claimed combination of parameters yields non-splash rinse conditions. Consequently, to the extent that the claimed invention involves the optimization of known parameters, a proposition with which Applicants disagree, the claimed combination of parameters is not recognized in the art to be a result-effective variable. As such, one having ordinary skill in the art would not have obtained the claimed invention by conducting routine experimentation based on the teachings of the Gockel patent.

In the event that the Examiner disagrees with Applicants’ position regarding the patentability of claims 25-31 over the Gockel patent, Applicants respectfully request that the Examiner cite references that support the allegation that the claimed parameters are “well-known variables in the art of cleaning semiconductor wafers and known to affect both the rate and quality of the cleaning process.” In support of this request, Applicants note that while an Examiner may take official notice of facts outside the record, those facts “should not comprise the principle evidence upon which a rejection is based.” M.P.E.P. § 2144.03.

Accordingly, for at least the foregoing reasons, independent claim 25 is patentable under 35 U.S.C. § 103(a) over the Gockel patent. Dependent claims 26-31, each of which depends from claim 25, are likewise patentable under 35 U.S.C. § 103(a) over the Gockel patent for at least the same reasons set forth above for claim 25.

In view of the foregoing, Applicants respectfully request reconsideration and reexamination of claims 1-11 and 21-31, as amended herein, and submit that these claims are in condition for allowance. Accordingly, a notice of allowance is respectfully requested. In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at **(408) 749-6902**. If any fees are due in connection with the filing of this paper, then the Commissioner is authorized to charge such fees to

Deposit Account No. 50-0805 (Order No. LAM1P109). A copy of the transmittal is enclosed for this purpose.

Respectfully submitted,
MARTINE & PENILLA, LLP

A handwritten signature in black ink, appearing to read 'P. B. Martine', with a long horizontal stroke extending to the right.

Peter B. Martine
Registration No. 32,043

710 Lakeway Drive, Suite 170
Sunnyvale, California 94085
Telephone: (408) 749-6900
Customer No. 25920

MARKED-UP VERSION OF AMENDED CLAIM

6. (Amended) A method of cleaning a surface of a semiconductor wafer following a plasma etching operation as recited in claim 1, wherein the operation of wetting the surface of the semiconductor wafer comprises:

setting a first delivery source and a second delivery source over the surface of the wafer in order to wet the surface of the wafer at a [predetermined] flow rate of water; and

setting the [predetermined] flow rate to be between about 50 ml/minute and about 300 ml/minute.